



## **Booster High level RF**

# **CLEANING REQUIREMENTS FOR ANODE POWER SUPPLY DC CABINET**

### **Purpose and Scope**

The purpose of this procedure is to outline and detail the process of cleaning the Anode Power Supply DC Cabinet internal equipment.

Both RF East and West Gallery Anode Power Supplies need to be cleaned and inspected annually. When working within the DC cabinet one must ensure that the proper precautions have been taken to remove all stored energy to safely work on the equipment.

### **Performance of Maintenance Activities**

**This procedure is always performed by two trained employees due to the dangerous voltages that may be present.**

All personnel who access or work within the described equipment must comply with the specific instructions and follow all Hazard Analysis procedures and related LOTO procedures defined in the document. In cases where unusual circumstances may require deviation from these instructions, the Department Head or his/her designee and all participating personnel shall discuss and agree upon an appropriate course of action.

For an overall view of this system, refer to the block diagram in Attachment 2.

### **Authorized Personnel**

An Accelerator Division employee is authorized to perform this procedure if he/she understands all Hazard Analysis procedures, has the necessary knowledge, including current training, and is authorization to perform the following LOTO procedures:

- **Booster Anode Power Supply LOTO procedure (ADDP-EE-9933)**

## Equipment

- Proper PPE per LOTO Procedures
- Ladder
- Cleaning supplies – including shop vac and air bottle
- Basic tools (wrenches, screwdrivers, pliers, etc.)

## The Steps of LOTO Prior to Maintenance Activity

### **Shutdown Procedure:**

The authorized employee shall shutdown or turn off the equipment or systems by using the normal shutdown procedure.

1. Place Anode Power Supply Control Panel in local mode. Disconnect all modulators from Anode Power Supply by using the Anode Power Supply Display Panel under **Subpage Switches**. Actuate the switches by pushing on the disconnect icon button for each Station. **Note:** The switches can only be connected/disconnected locally!
2. **Leave the Anode Power Supply Control Panel in local mode.**
3. **Lock Out/Tag Out:** The authorized employee shall isolate, relieve, restrain, and verify the sources of AC energy feeding the Anode Power supply using the **Booster Anode Power Supply LOTO procedure** (ADDP-EE-9933).

## **The Steps for DC Maintenance Activity**

1. If LOTO has been performed at an earlier date, verify that LOTO is still valid with all grounds and grounding hooks in place before entering the DC cabinet.
2. Inspect all grounds for their integrity. (Worn clamps, damage to hooks and cables fraying)
  - a. Door mounted grounding sticks
  - b. Capacitor bank grounds. (All banks, including non-circuit inserted)
  - c. Water-cooled resistor grounds.

## **Cleaning**

3. **Input DC Cabinet transformer Secondary Bushings**
  - a. Ceramic
  - b. Buss work
4. **Surge Suppressors**
  - a. All three phases
5. **Water Cooled Resistors**
  - a. Lower ceramic insulators
  - b. Check ground connection cables - secured at the top, look for frayed cables and cable secured to the ground clamp, etc.
6. **Diode Bridges Banks**
  - a. Blow out diode bridge bank modules with bottled air.
  - b. Locate and inspect diode bridge bank cables both top and bottom, tighten/replace worn parts if necessary.
7. **Capacitor Bank**
  - a. **Ground each capacitor in the Anode Power Supply independently before performing maintenance on the cap bank! Required PPE is:**
    - i. **Arc thermal protection value 8 cal/cm<sup>2</sup> FR**
    - ii. **Cotton clothing under Fr Coverall, Hood, Hearing protection, leather gloves, and leather work shoes.**
    - iii. **Do not rely on bleeder resistors.**
  - b. Clean the capacitors Insulators.
  - c. Locate the capacitor bank's ground bus and clean its isolation door knobs.
  - d. Inspect and clean capacitor's series resistors. Inspect resistors and look for cracking or discoloration of resistor body.
8. **Bleeder Resistors**
  - a. Inspect and clean each of the eight bleeder resistors. (100K @ 1000W)
  - b. Verify and tighten if necessary, all connections to the B+ and ground buss.

**9. RF Station Modulator HV Switches**

- a. Check the integrity of the ground connections for each modulator switch.
- b. Check the integrity of the B+ connections for each modulator switch.
- c. Check the integrity of the modulators' B+ cable for each modulator switch.
- d. Inspect the contact cylinder for evidence of arcing or sparking on each modulator switch.
- e. Inspect the switches' contact wiring block for loose connections.
- f. Exercise each modulator switch to visually verify and listening for the opening and closing of the micro switch.

**10. High Voltage Divider (Blue Cylindrical Device)**

- a. Locate inspect and clean the high voltage divider which is hanging from the ceiling above the ignitron housing box.
- b. Locate inspect and clean DC current monitor which is hanging from the ceiling next to the last modulator switch above the water-cooled resistor.

**11. Anode Power Supplies Heat Exchanger**

- a. Clean radiator fins with vacuum cleaner.
- b. Inspect and clean drainage mat and drain.

**12. Brass Box - Crowbar Chassis**

- a. Take and record reading on crowbar chassis front panel meter.

**13. Anode Power Supply Door Switches.**

- a. Check all door interlock switches for mechanical functionality.
- b. Check all door interlock switches wiring for fraying and tight connections.

**14. Anode Power Supply Ground Hooks**

- a. Check the integrity of the ground connections at the ground hook and grounding point.
- b. Check the door ground hook interlock switches for mechanical functionality.
- c. Check the door ground hook interlock switches wiring for fraying and tight connections.

**15. Anode Power Supply Door Filters**

- a. Replace if need APS door filters. (14 x 20 x 1)

### **Returning Anode Power Supply into Service**

1. If further maintenance is required within the Anode Power Supply or on any of the Booster RF Systems, leave DC cabinet in a LOTO'd configuration.
2. If no further maintenance is required within the Anode Power Supply or on the Booster RF systems within that gallery, follow the **Booster Anode Power Supply Lock Out/Tag Out Procedure, returning to Service section**. This must be performed by an authorized employee using the **Booster Anode Power Supply LOTO procedure** (ADDP-EE-9933).